Title:
An On-Farm Soybean IPM Education Program

Project Leaders:
Julianne Stavisky, NYS IPM
Kenneth Wise, NYS IPM
J. Keith Waldron, NYS IPM

Cooperators:
Mike Stanyard, NWNY Dairy, Livestock, and Field Crops Team
Jeff Miller, CCE of Oneida County

Type of grant:
Training practitioners to use IPM techniques

Project locations:
Cayuga County, Oneida County, Orleans County

Abstract:
New pest challenges in soybeans led to the development of an on-farm, season-long soybean IPM education program based on the TAg Team model in 2005. Three soybean TAg teams were established. Participants learned to identify and manage key pests. An emphasis was placed on learning plant growth stages to help participants understand the vulnerable stages in plant growth and development, and to correctly time management actions. As a result of our IPM educational efforts through soybean TAg team participation, producers are more vigilant than ever toward pests in their soybeans and are better equipped to reduce environmental and economic risks associated with pest management.

Background and justification:
For many producers, soybeans fit well with their field crop rotations, provide a useful homegrown source of livestock feed, and offer a valuable cash crop option. In New York State, soybean acreage has increased over 4 fold since 1989 with an estimated 175,000 acres planted in 2004 (1989-2004 NYS Ag Stats). The trend in soybean acreage expansion is expected to continue as local markets are enhanced by availability of commercial roasters and oil processing plants. As soybean acreage has increased, so have producer questions regarding crop protection.

Until recently, soybean pest concerns have been minimal in the northeast, generally restricted to weeds, insect, disease and vertebrate pests affecting emergence, vegetative and reproductive phases of crop development. Given our Northeastern pest spectrum, many pest impacts have largely been minimized or avoided through an integrated approach based on selecting varieties for maturity group, disease resistance, and commercial commodity attributes and the timely implementation of sound agronomic practices including crop rotation. Regular field monitoring for pests and crop condition is encouraged to alert producers of potential problems (2006 Cornell Guide for Integrated Field Crop Management).

With the detection of soybean rust in the southeastern US in November of 2004, many experts speculated that rust could have a substantial impact on soybean pest management in the 2005 growing season. In response, producers anticipated a need to be proactive in learning how to manage the problem should rust appear in New York. A season-long on-farm soybean education program will play a major role in effectively communicating with small groups of producers about Asian soybean rust identification and management. In addition, soybean

aphid, a pest that was first documented in New York in 2001, has also dramatically increased the need for sound IPM education for soybean producers.

Weed management in soybeans will continue to be an important area for educating producers. While initially intended to be used occasionally to clean up weeds from problem fields, estimates from field crop extension educators indicate that at least 90 % of soybeans planted are Roundup Ready varieties. This management technique appears to work adequately, but it is essential for IPM educators to be proactive in keeping soybean growers alert about the potential risk of developing herbicide resistance, shifts in the time of occurrence of weed species, and the availability of other Roundup Ready crops such as field corn and alfalfa could complicate the use of this technology in the near future.

With two new exotic pests, numerous other occasionally severe pests, as well as ongoing weed management challenges, it is crucial to develop an educational delivery method that Cooperative Extension and other personnel can easily use in IPM outreach.

On-farm education has been shown to increase participation and rates of adoption (Wuest et al. 1995; Flora 1991). Wuest et al. (1995) indicate that conducting education on the farm increases the rate of adoption of specific practices about which producers raise questions. The direct participation of growers in Tactical Agriculture, or TAg teams has a proven record of results in other field crops in recent years in New York State. In a TAg program, IPM and ICM education is conducted (1) on the participant's farm, (2) in small learning groups (3) with hands-on learning over the course of a growing season. The current TAg model focuses primarily on presenting IPM and ICM information related to field corn, alfalfa, and to a lesser extent dairy cattle. For more information about TAg, please visit the following section of the New York State IPM website: http://www.nysipm.cornell.edu/lfc/tag/tag_intro.html The TAg program teaches a decision-making process. Many IPM options are presented, and participants are taught how to assess pest levels, and how to evaluate need, appropriateness, timing, and effectiveness of various management interventions. We encourage producers to consider and use non-pesticide options but to also include judicious use of chemical control tactics when appropriate. In addition to a set of basic topics to be addressed, the flexible nature of TAg programs allows facilitators to address unique situations or local concerns.

New pest challenges in soybean led to interest in the expansion of TAg, an on-farm season-long approach to pest management education for soybean producers. Conducting the soybean TAg meetings on the farms of participating producers encourages their interest and involvement and increases the likelihood that they will use the information being taught. In addition, on-farm locations of TAg meetings provide ideal opportunities for direct observation of potential disease, insect, and weed pest outbreaks. Enhanced soybean IPM implementation efforts will improve the exchange of information between producers and extension personnel. The observations, perceptions, concerns, and suggestions of producers will help to strengthen development of appropriate research-based information resources to better assist in teaching of soybean IPM in the future.

Objectives:

1. Conduct on-farm season-long integrated pest management education programs for soybean producers across New York State. Critical pests including soybean rust and soybean aphid will be emphasized.
2. Evaluate the impact of the program by measuring the level of adoption of integrated pest management (IPM) and integrated crop management (ICM) practices by participating soybean producers.

Procedures:

1. Conduct on-farm season-long integrated pest management education programs for soybean producers across NYS.

Working with our cooperative extension colleagues (Jeff Miller, Oneida County; Mike Stanyard, NWNY Dairy and Field Crops Team; and Shawn Bossard and Dan Welch, Cayuga County), 3 teams of producers were invited to participate in the program. Selection of participants was based on producer requests for soybean information or on concentration of soybean acreage in areas that have not been targeted by IPM extension efforts. The number of producers varied from 3 to 6 per team. More details on farm size are shown in Table 1.

Table 1. Description of participants in Soybean TAg in 2005

County	Number of Farms	Acres of Soybeans	Total Acreage of Farming Operations
Oneida	5	965	4,900
Orleans	6	2,415	7,200
Cayuga	3	1,860	5,100

The TAg teams met about once a month within each county at one of the participant's farms to learn the subject being delivered and practiced for that time of the season. Teaching was primarily the responsibility of the local field crop extension educator, and the IPM Area Educators worked cooperatively to teach specific topics. Prior to soybean planting, we gathered resources and developed lesson plans, brochures, and scouting calendars. Early May meetings were held to introduce the participants to the soybean TAg program and to administer a pre-questionnaire to assess current pest and crop knowledge. We used results to help shape our educational curriculum. Also at the first meeting, a survey of current practices was conducted.

During the second set of meetings in mid June, we conducted stand counts, provided an update on soybean rust development in the southeast, practiced soybean aphid scouting (including monitoring for natural enemies), and conducted a weed assessment. An emphasis was placed on understanding plant growth stages to help participants understand vulnerable stages in plant growth and development, and to correctly time management actions. The next meetings were in mid to late July. The July meeting in Orleans County focused in large part on learning about spider mites given that the field where we met was severely infested. The impromptu spider mite training at this meeting provided an "educational moment," demonstrating the ability of TAg teams to flexibly meet the real in-field educational needs of producers. Also at the July meetings, we concentrated on the foliar diseases of soybean, with an emphasis on how to distinguish each observed disease from soybean rust. Further descriptions of the topics taught and the time of year at which they were taught are presented in Table 2.

Table 2. Topics presented each month at on-farm Soybean TAg meetings

Meeting Time	Topics Taught
May	Early season insect pests Soybean Rust update
June	Soybean stages of growth Plant population assessment - stand counts Seedcorn Maggot, Slugs Early Season disease pests: seedling rots and blights Soybean Aphids Weed identification and management
July	Soybean Aphid identification and management Spider mite identification and management Soybean Rust and other foliar diseases

	White mold
August	Defoliating insects Soybean rust update Weed Identification and Management Soybean rust update Farm-by-farm season-long pest management review
September	Management of pests of stored soybeans Soybean Harvest Issues Planning for next year's crop: Crop rotation, variety selection

In addition to serving as the locations at which meetings are held, enrolled fields were scouted by an individual hired through this project in Orleans County. Scouting reports were shared with producers weekly, and scouting data was used as a basis for discussion at each TAg team meeting. Producers learn more and are more likely to adopt IPM and ICM practices when pest scouting data collected from their own fields are presented. Obtaining field observations at regular intervals helped to reinforce to producers the value of scouting their other fields during the current season and all of their fields in the future. The scouting data also was compiled and posted on the NYS IPM website in a weekly pest update newsletter: http://nysipm.cornell.edu/fieldcrops/tag/pestrpt/default.asp. The pest newsletter was emailed to all field crop county Extension Educators and Specialists across NY.

2. Evaluate the impact of the soybean IPM education program by measuring the level of adoption of IPM and ICM practices by participating producers.

Program impacts were measured through pre- and post-testing participants to determine changes in their knowledge and use of IPM practices on their farm. The TAg team approach has the potential to dramatically increase knowledge and the rate of adoption of IPM practices. After soybean TAg participants enrolled in the program they completed a pre-test covering the information that was to be presented over the course of the growing season. An assessment was conducted to determine pest management practices that TAg participants use at the beginning of the program. Pre-testing helped in identifying participant subject matter strengths and weaknesses and enabled facilitators to adjust presentation topics to best meet educational needs of clientele. After the completion of the Soybean TAg program participants took a post-examination and an exit survey to measure changes in knowledge and the level of adoption of Soybean IPM practices on their farms. Program evaluation included documentation of changes in knowledge of IPM, future scouting activities, changes in pesticide usage, changes in cropping strategies to reduce pest and environmental problems, changes in practices for selection of crops and varieties for pest control, plans for future scouting activities, and more. Feedback provided on the post-test and exit survey will be used to continue improving the Soybean TAg program for future years.

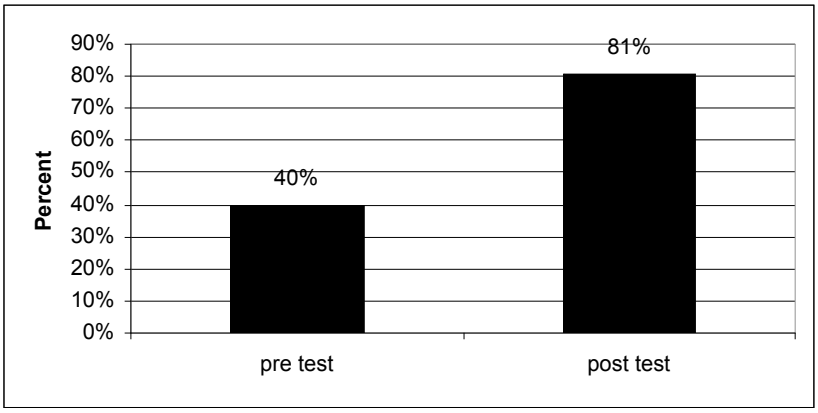
Results and discussion:

On the pre-test, participants across all 3 counties answered fewer than half of the questions correctly. While many of the questions concerning basic agronomic concepts were answered correctly, few participants were able to answer questions about soybean pest identification and management. Two personnel changes occurred within the Cayuga County CCE during the course of the 2005 growing season. The last 3 meetings and the post-evaluation did not take place in Cayuga County due to the lack of continuity. We were reminded that a TAg team requires a very committed local educator for success. The following results are from the successfully completed Oneida and Orleans County Soybean TAg Teams.

KNOWLEDGE OF IPM AND ICM

Results of the pre and post tests indicated that soybean TAg participants dramatically increased their knowledge of IPM and ICM. Across 2 counties (Orleans and Oneida), test scores doubled from 40% to 81% (see figure 1.)

Figure 1. Average Soybean TAg pre-test and post-test scores (11 participants)



ADOPTION OF IPM AND ICM

The majority of producers indicated that they "will do" or "will try" most of the general IPM practices and soybean IPM practices learned during the Soybean TAg training. See Tables 3 and 4 for specific tactics that will be implemented and percentage of participants who will implement them.

Table 3. Planned implementation of general IPM principles by participants in Soybean TAg

	percent of participants who:		
IPM Practice	Will do	Will try	Will not do
Keep scouting records, records of management decisions, and records of management actions	56	44	0
Use threshold tables and guidelines	78	22	0
Prepare IPM scouting plan before the growing season begins	11	78	11
Collect reference material to help plan your IPM program	33	67	0
Consult you extension educator or IPM educator for new information	78	22	0

Table 4. Planned implementation of IPM principles in soybean production by participants in soybean TAg

	percent of participants who:		
IPM Practice	Will do	Will try	Will not do
Perform stand counts	33	67	0
Conduct spring and fall weed identification and surveys	67	33	0
Monitor for weed escapes from herbicides	89	11	0
Scout for diseases: Septoria brown spot, Asian soybean rust, downy mildew, white mold	89	11	0
Scout for soybean aphid and spider mites	100	0	0
Monitor for beneficial insects	100	0	0

Time herbicide treatments carefully based on plant growth stage	56	33	11
Time fungicide treatments carefully based on plant growth stages and presence of diseases	67	33	0
Time insecticide/miticide treatments based on plant growth stages and threshold numbers of insects/mites, and take weather conditions into consideration	89	11	0
Use economic thresholds to guide insect and disease management decisions	89	11	0
Make pest management decisions based on stand health, growth stage, and yield potential	89	11	0

All of the producers indicated that they "will do" or "will try" the ICM practices learned during the Soybean TAg training. See Table 5 for specific tactics that will be implemented and percentage of participants who will implement them.

Table 5. Planned implementation of ICM principles in soybean production by participants in soybean TAg

	percent of participants who:		
ICM Practice	Will do	Will try	Will not do
Conduct soil testing to determine proper fertilization needs	100	0	0
Use crop rotation to control weeds and diseases	75	25	0
Review the soil test results with your CCE educator	50	50	0

Emphasis was placed on educating participating producers about two new invasive pests of soybeans. Soybean aphids have been present in NY for several years, and occasional severe infestations have caused yield losses. However, many producers do not make management decisions based on field observations and economic thresholds. Soybean aphid identification, scouting, and management were major topics covered during soybean TAg. Although Asian soybean rust has not yet been detected in NY, producers were concerned about the possible occurrence of this disease. In our program evaluation, we emphasized these two pest problems with the following questions: Because of TAg, 1) Do you feel more knowledgeable about Asian soybean rust?; 2) Do you have an improved ability to scout for soybean diseases and to distinguish common diseases from rust?; 3) Are you more knowledgeable about whom to contact in case of the appearance of rust?; and 4) Are you more knowledgeable about soybean aphid life cycle, damage, and thresholds? All participants answered yes to all four questions. Demonstration of their increased knowledge was demonstrated in post-test results.

This was the first year that the soybean TAg program was implemented. Both our experiences and feedback from participants have been very positive, indicating that the traditional (alfalfa and field corn) TAg educational model is flexible enough to be adapted to IPM education in a variety of cropping situations. Based on our experiences, we are developing educational modules to help extension personnel prepare for implementation of future soybean TAg efforts. As word has spread throughout NY about the value of the program, many other producers have already expressed interest in participating in an on-farm soybean IPM education team in the future.

Funding: This project was supported through a 2005 grant from the Northeast Soybean Promotion Board

References:

Cherney, J.H., W. J. Cox, R.R. Hahn, E.Z. Harrison, Q.M. Ketterings, M.B. McBride, W.S. Reid, R.R. Schindelbeck, H.M. vanEs, E.J. Shields, M. Smith, G.C. Bergstrom, K.J. Czymmek, and J.K. Waldron. 2005. 2006 Cornell Guide for Integrated Field Crop Management. Cornell University, Ithaca, NY. 142 pp. (www.fieldcrops.org).

Flora, B. F. 1991. Research Priorities for Sustainable Agriculture. Conference proceedings: Setting Priorities: Research, Practice and Policy for a More Sustainable Agriculture. Leopold Center for Sustainable Agriculture.

New York Agricultural Statistics Annual Bulletin. 2004. New York Agricultural Statistics Service.U.S. Department of Agriculture.

Wuest , S. B., Guy, S. O., Smith L. J. and Miller, B. C. 1995. On-Farm Tests as a Tool for Extension Programming. Journal of Extension 33: 4.

Samples of materials:

QUOTATIONS FROM PARTICIPANTS

In response to the following questions:

- What is one production practice you plan to change next year based on information learned during the Soybean TAg program this year?
  - scouting more
  - seed treatment of some kind - for seed corn maggot
  - More scouting
  - Scout for pests better and timely weed control

- Please describe a situation in which the TAg experience helped you with a pest, crop management, or economic situation on your farm this season:
  - Kept us from spraying for soybean aphid
  - Scout fields more for soybean aphids
  - Finding aphids and mites in the early stages
  - We had a good infestation of spider mites this year. We learned more about control and sprays.
  - Greatly aided decision making process in regard to insect spraying decisions and timing
  - We used lorsban to control aphids and spider mites instead of warrior that we used last year to control aphids

- Please indicate ways in which we may be able to improve the TAg experience:
  - Looking at other farmers and different situations of planting and spraying opens your eyes to other ways of doing things.
  - Hands-on experience means a lot.
  - Seeing and identifying diseases and insect pests on the plants was nice.
  - Make it a 2 year program
  - Possibly follow up again post harvest and look at results of any trials conducted - foliar feeding, insect spraying, etc.
  - It might be beneficial to visit each farm in the group privately to meet. You could be more detail with each group member

- Do you have any other comments about the TAg program?
  - It's a very good program that has been very helpful to me this year and years to come. I would recommend this to anyone.

- I really learned a lot. Thank you.
- We need to do it next year
- Appreciate your motivation to get meetings and groups together.